CEL California Eastern Laboratories

ZIC2410 Series

CEL
Profile-Builder
Software Manual

0005-05-08-16-001
(Rev C)

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1 INTRODUCTION

This is the user manual for the CEL ***Profile-Builder*** program. ***Profile-Builder*** assists users in easily creating ZigBee™ profiles. In conjunction with a 'C' compiler, the user can create custom application capable of being programmed into the internal Flash memory of the **ZIC2410**.

Profile-Builder is used by inputting the application requirements into the ZigBee profile format, which then modify a set of 'C' source files that become customized with the necessary functionality. The source files will contain both the ZigBee Device Object (ZDO) and ZigBee Device Profile (ZDP) descriptors, which define a ZigBee node and its functionality. The generated files can be integrated with the supplied ***CEL ZigBee Stack*** in order to create a user's unique application.

1.1 REFERENCED DOCUMENTS

Category	*filename (.pdf)*	*Document Name*
Application Profile	*053520r25*	***ZigBee Home Automation Public Application Profile*** *(from the ZigBee Alliance)*
Stack API References	*zic04_zcl_api*	***ZIC2410 User Guide Profile and ZigBee Cluster Library (ZCL)***
	zic06_zdo_api	***ZIC2410 User Guide ZigBee Device Object (ZDO)***

2 INSTALLATION

The CEL ***Profile-Builder*** application has been tested under the Windows XP Professional operating environment. Support for Windows Vista is untested and cannot be guaranteed, but successful operation has been reported once Windows XP Compatibility has been enabled. For details on enabling Windows XP compatibility in the Windows Vista operating system see Appendix A of this document.

2.1 INSTALLING THE *PROFILE-BUILDER* PROGRAM

The installation program for the CEL ***Profile-Builder*** application can be found on the CD in the **\ZIC2410\Tools\CEL ZigBee Profile-Builder** directory. The following is the detailed installation procedure.

1) Double click **'Setup.exe'**. The screen in Figure 1 will be displayed. Click **'Next'**.

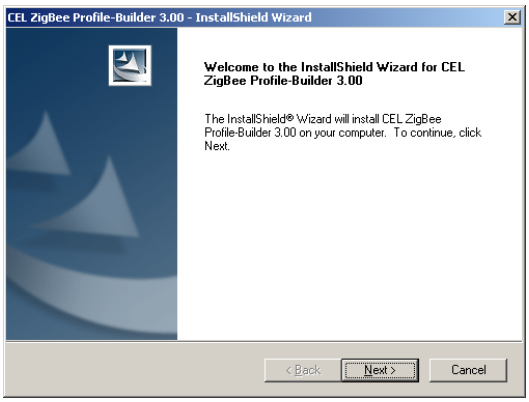
CEL ZigBee Profile-Builder 3.00 - InstallShield Wizard
Welcome to the InstallShield Wizard for CEL ZigBee Profile-Builder 3.00
The InstallShield® Wizard will install CEL ZigBee Profile-Builder 3.00 on your computer. To continue, click Next.
< Back
Next >
Cancel

Figure 1 – *Profile-Builder*, Welcome

2) Read the License Agreement, select **'I accept the items of the license agreement'** and click **'Next'**.

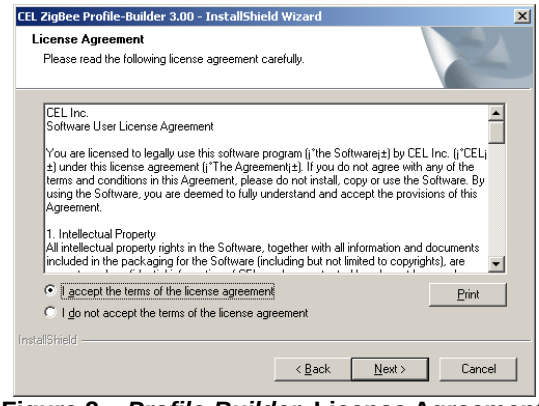
CEL ZigBee Profile-Builder 3.00 - InstallShield Wizard
License Agreement
Please read the following license agreement carefully.
CEL Inc.
Software User License Agreement
I accept the terms of the license agreement
I do not accept the terms of the license agreement
Print
InstallShield
< Back
Next >
Cancel

Figure 2 – *Profile-Builder*, License Agreement

3) Type in a user name and company name and click **'Next'**.

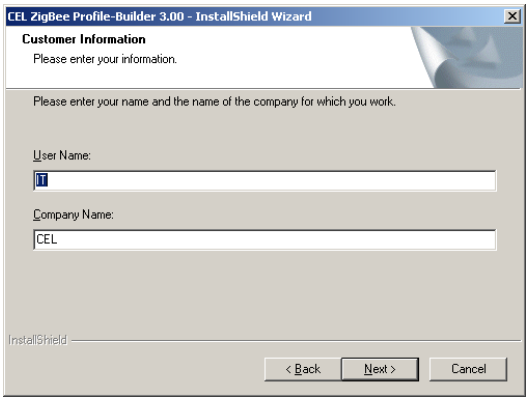

Figure 3 – *Profile-Builder*, Customer Information

4) Select the installation path and click **'Next'**. (By default, the installation path is set to **C:\Program Files\CEL\CEL ZigBee Profile-Builder 3.00**)

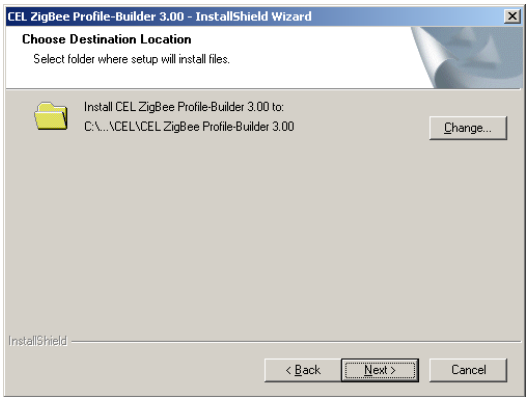

Figure 4 –*Profile-Builder*, Installation Location

5) Click **'Install'** to begin the installation.

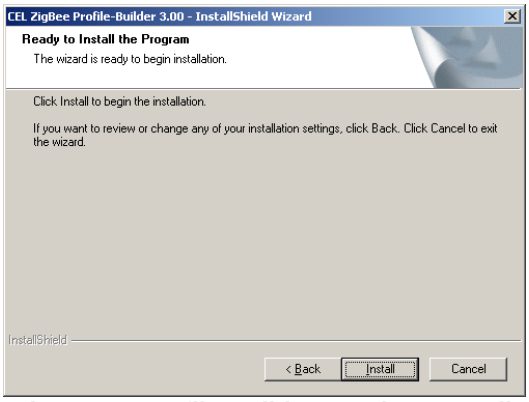
CEL ZigBee Profile-Builder 3.00 - InstallShield Wizard
Ready to Install the Program
The wizard is ready to begin installation.
Click Install to begin the installation.
If you want to review or change any of your installation settings, click Back. Click Cancel to exit the wizard.
InstallShield
< Back
Install
Cancel

Figure 5 – *Profile-Builder*, Ready to Install

6) During installation the screen in Figure 6 will be displayed.

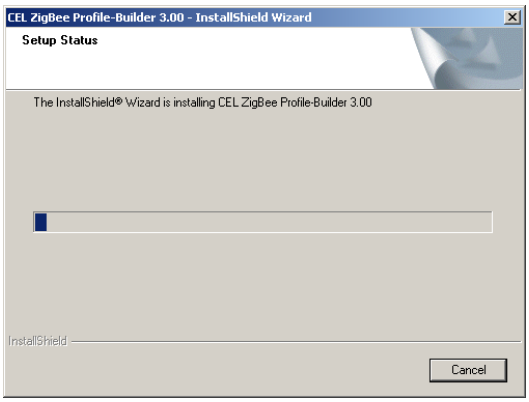
CEL ZigBee Profile-Builder 3.00 - InstallShield Wizard
Setup Status
The InstallShield® Wizard is installing CEL ZigBee Profile-Builder 3.00
InstallShield
Cancel

Figure 6 – *Profile-Builder*, Setup Status

7) When the installation is complete the message below will display. Click **'Finish'** to exit the installation process.

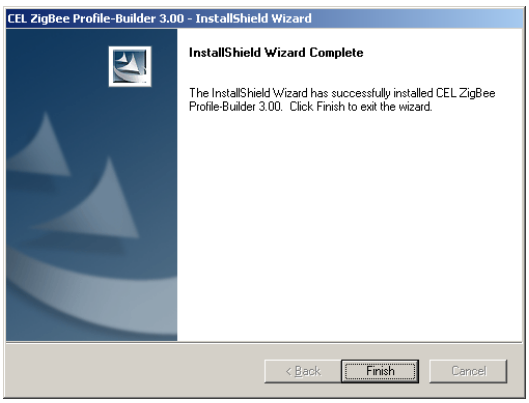
CEL ZigBee Profile-Builder 3.00 - InstallShield Wizard
InstallShield Wizard Complete
The InstallShield Wizard has successfully installed CEL ZigBee Profile-Builder 3.00. Click Finish to exit the wizard.
< Back
Finish
Cancel

Figure 7 – *Profile-Builder*, Installation Complete

The CEL ***Profile-Builder*** application has been successfully installed. The icon should now be displayed on your desktop.

3 STARTING PROFILE-BUILDER

Click on the ***Program-Builder*** icon on the user's desktop; Figure 8 showing the opening window of the program should appear.

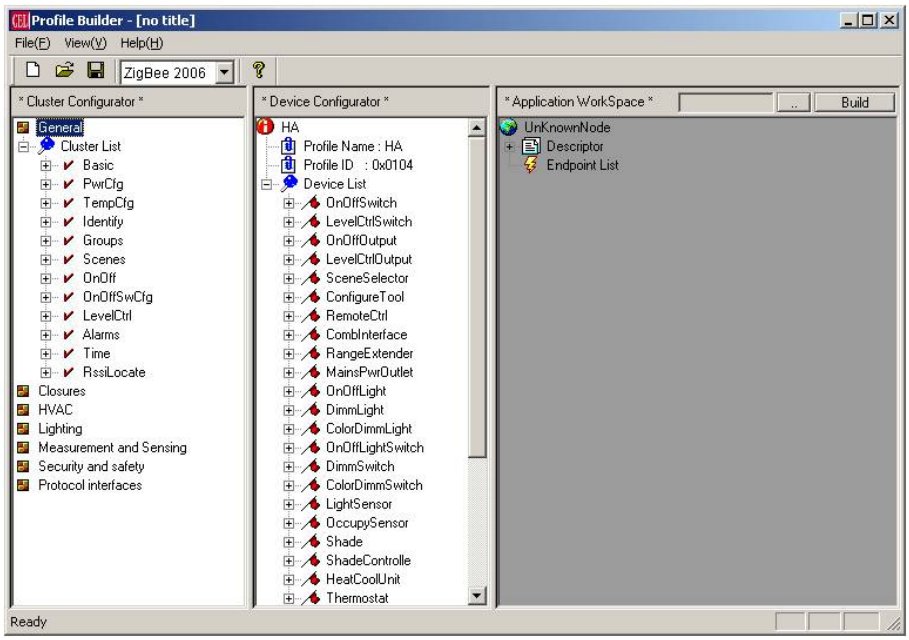

Figure 8 – Screen, *Profile-Builder* (Opening)

Profile-Builder includes the ZigBee 2006 standard cluster of the ZigBee Cluster Library and the complete device list defined in the Home Automation Profile. These files cannot be deleted or manually edited. For more detailed information, please refer to the ***"ZIC2410 User Guide Profile and ZigBee Cluster Library (ZCL)"*** supplied by CEL and the ***"ZigBee Home Automation Public Application Profile"*** document supplied by the ZigBee Alliance.

The ***Profile-Builder*** screen consists of three main sections: a **Cluster-Configurator**, a **Device-Configurator** and an **Application WorkSpace** with the following functions:

- **Cluster-Configurator:** Defines the cluster from the ZigBee Cluster Library
- **Device-Configurator:** Defines an application profile and logical device.
- **Application WorkSpace:** Defines the physical ZigBee device**.**

Using the **'Build'** function, a user can define the functions of a ZigBee node in the three areas above and generate the 'C' source files and header files in the format required by the ***CEL ZigBee Stack***.

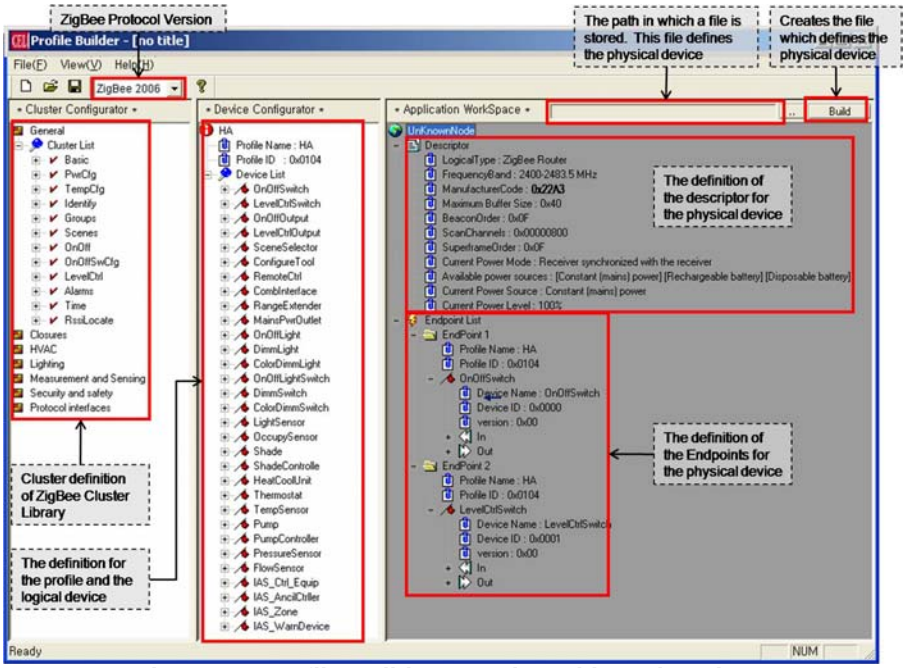
ZigBee Protocol Version
The path in which a file is stored. This file defines the physical device
Creates the file which defines the physical device
Profile Builder - [no title]
File(F) View(V) Help(H)
ZigBee 2006
Cluster Configurator
Device Configurator
Application WorkSpace
Build
The definition of the descriptor for the physical device
The definition of the Endpoints for the physical device
Cluster definition of ZigBee Cluster Library
The definition for the profile and the logical device
Ready
NUM

Figure 9 – *Profile-Builder*, Opening with explanations

Caution: ***Profile-Builder*** can define profiles for both ZigBee 2004 and ZigBee 2006 versions. However, the ZIC2410 **ONLY** supports ZigBee 2006. Therefore, this document only explains how to define the ZigBee Cluster Library Profile for the ZigBee 2006 version.

Table 1 describes the Toolbar of the ***Profile-Builder***.

Table 1 – *Profile-Builder* Toolbar Items

Toolbar	Menu	Keystroke	Description
	File-New…	Ctrl+N	Creates and initializes a .zprj file for a new profile project.
	File-Open	Ctrl+O	Loads a previously saved profile.
	File-Save	Ctrl+S	Stores the generated profile as a file.
	ZigBee Protocol Version		Selects the targeted ZigBee version

3.1 STEP 1: GENERATING A CLUSTER FROM THE CLUSTER LIBRARY

In the Cluster Configurator, a user can define a new cluster which is not already defined in the ZigBee 2006 Cluster Library.

3.1.1 Generating a Cluster

Double-click one of functional domains (General, Closures, HVAC, Lighting, Measurement and Sensing, Security and Safety or Protocol Interface) in the Cluster Configurator Section. Right-click the mouse on the **'Cluster List'** located below the cluster type. The pop-up menu of cluster operations as shown in Figure 10 will appear with the following choices:

- **Insert User Cluster**: Add new cluster.
- **Remove All Clusters**: Delete all clusters in the selected type.
- **Remove Cluster**: Delete selected cluster.
- **Properties**: Check and modify the setting value of cluster.

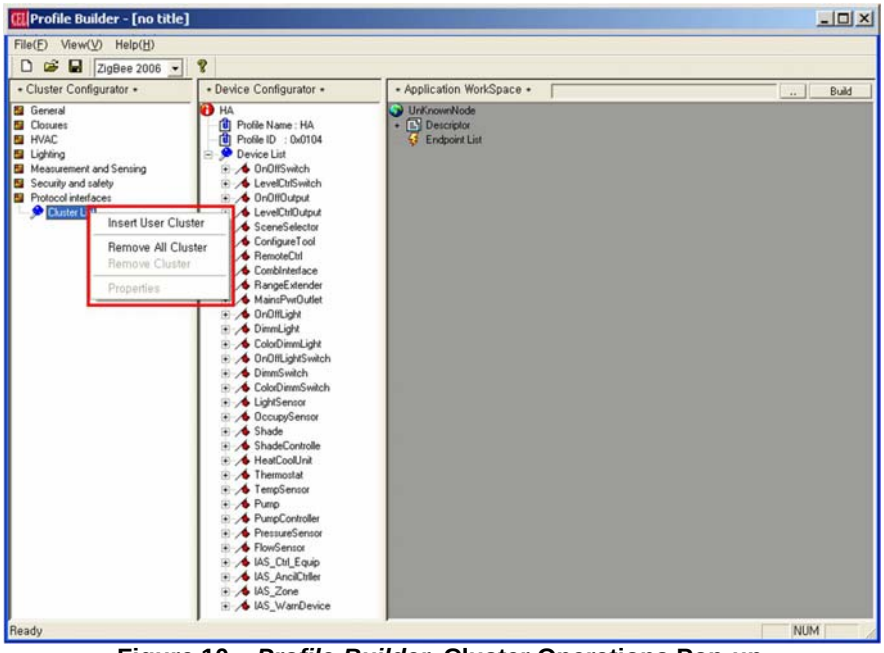

Figure 10 – *Profile-Builder*, Cluster Operations Pop-up

Select **'Insert User Cluster'** to display the window in Figure 11. To define a new cluster, fill in the three fields and click **'OK'**:

- **Functional Domain**: The cluster type of ZigBee Cluster Library.
- **Cluster Name**: A unique cluster name in the ZigBee Cluster Library.
- **Cluster ID**: A unique cluster ID in the ZigBee Cluster Library.

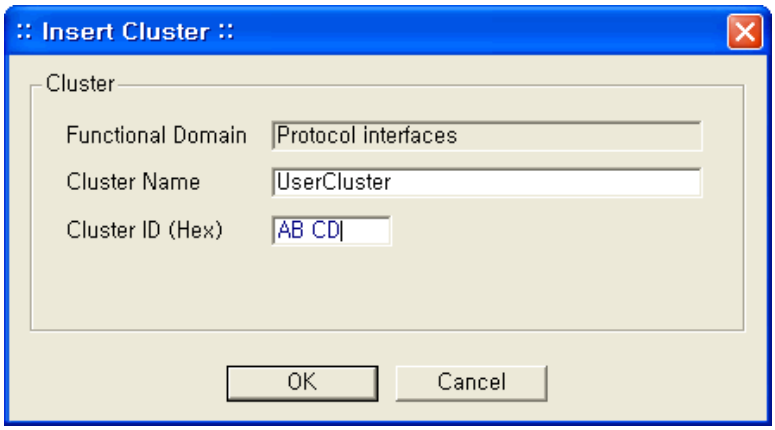

Figure 11 – *Profile-Builder*, Defining a New Cluster

If either the Cluster Name or the Cluster ID is not unique, the ***"This cluster name (ID) already exists"*** message is displayed. If successful, a new cluster will be displayed in the Configurator Window as shown in Figure 12. Once the Cluster exists, attributes can be generated.

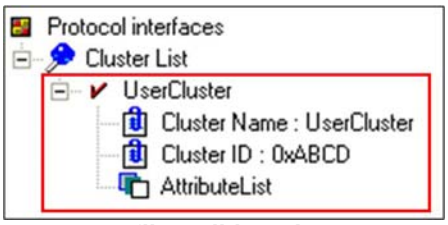

Figure 12 – *Profile-Builder*, Cluster Generated

3.1.2 Generating an Attribute

In the Cluster Configurator, double click on the cluster in which to add the attribute. Figure 12 will be displayed. Right-clicking the **'Attribute List'** will bring up the pop-up menu in Figure 13. Add, delete or edit an attribute by selecting the corresponding item.

- **Insert User Attribute**: Add new attribute.
- **Remove All Attribute**: Delete all attributes in cluster.
- **Remove Attribute**: Delete selected attribute.
- **Properties**: Check and modify the selected attribute.

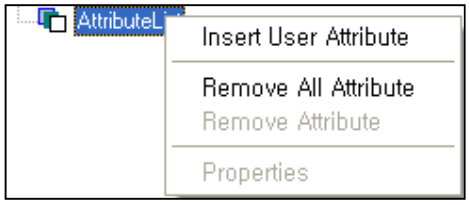

Figure 13 – *Profile-Builder*, Attribute Pop-up

Click **'Insert User Attribute'**, and the window in Figure 14 is displayed. To define a new attribute, fill in the five fields and click **'OK'**:

- **Functional Domain**: The cluster type of ZigBee Cluster Library.
- **Cluster Name**: Cluster name to which this attribute is included.
- **Attribute Name**: Unique name within the cluster for the attribute.
- **Attribute ID**: The ID within the cluster for the attribute (Acceptable values: 0x0000-0xFFFF).
- **Data Type**: Data type (size) of the attribute.

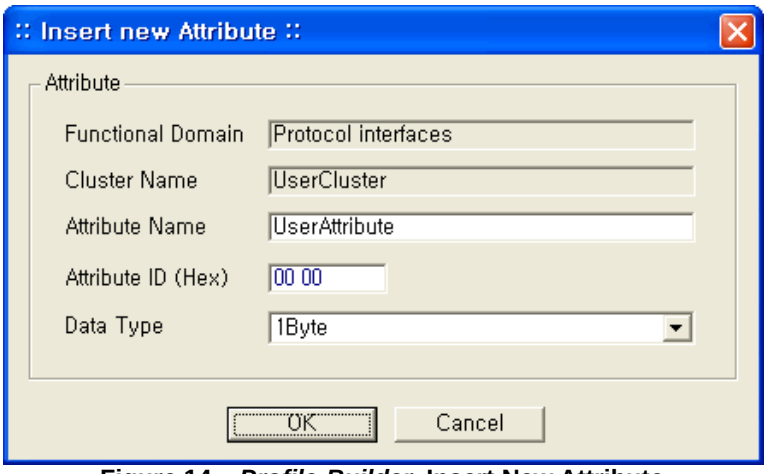

Figure 14 – *Profile-Builder*, Insert New Attribute

As shown in Figure 15, a new attribute is generated after setting the attribute values. The user can add other attributes as shown above.

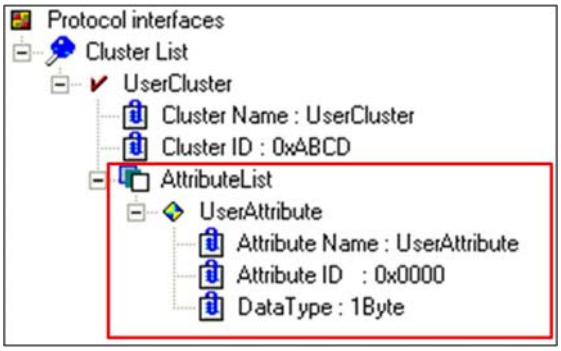

Figure 15 – *Profile-Builder*, Generate New Attribute

3.2 STEP 2: GENERATING A ZIGBEE PROFILE AND LOGICAL DEVICE

In the Cluster Configurator a specific application profile can be defined, such as a Remote Monitoring or Sensor Network. In addition, the logical device can be generated which defines the specific application such as Light On/Off, Switch On/Off, etc. through operations on the profile.

A logical device is a functional unit, which defines the operation of a specific application. One logical device exists for every one End-point application in a physical ZigBee node. For example, if the End-point in operation is a 3-in-1 physical ZigBee node, it means that there are three logical devices (two lights and one switch).

3.2.1 Generating a Profile

As shown in Figure 16, a pop-up menu for a profile can be generated by right-clicking the mouse on the profile name to add, modify or delete a profile.

- **Insert User Profile**: Add new user profile.
- **Remove All Profiles**: Delete all profiles.
- **Remove Profile**: Delete selected profile.
- **Properties**: Check and modify the selected profile.

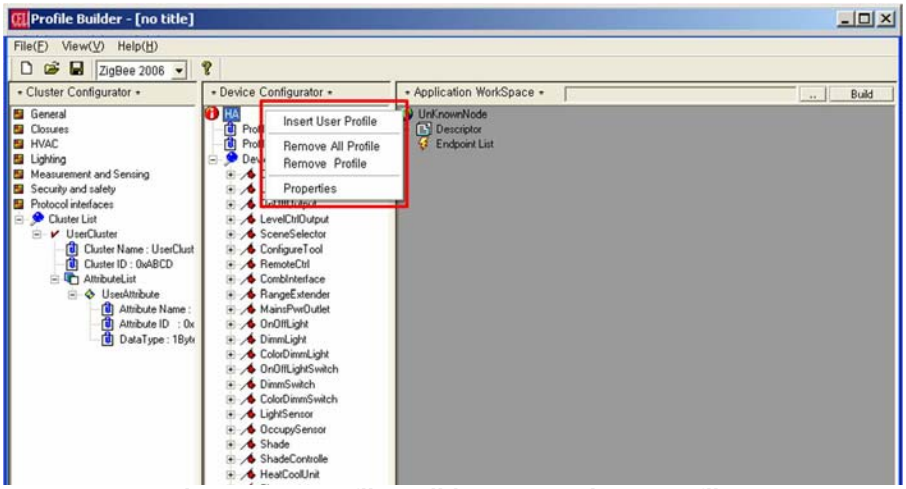

Figure 16 – *Profile-Builder*, Generating a Profile

To define a new profile, select **'Insert User Profile'** and fill in the two fields and click **'OK'**:

- **Profile Name**: Unique profile name (Spaces or special characters are not allowed.)
- **Profile ID**: Unique profile identification (Acceptable values: 0x0001-0xFFFF).

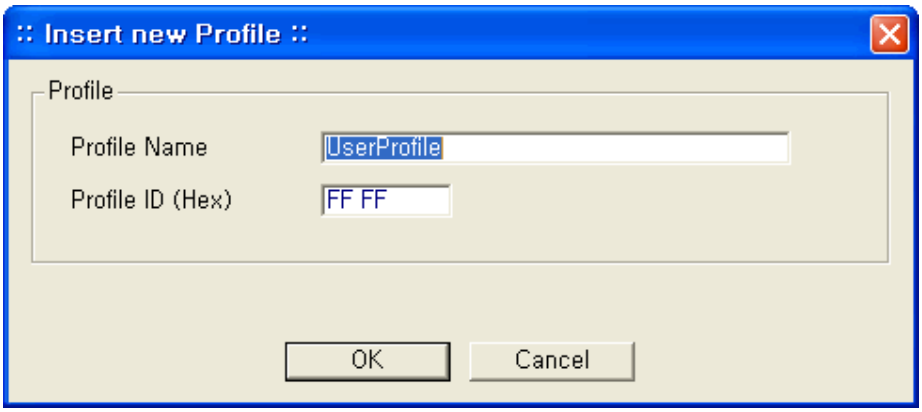

Figure 17 – *Profile-Builder*, Inserting a New Profile

As shown in Figure 18, a new profile is generated after adding the user-defined profile. Once a new Profile has been created, a logical device can be generated.

Figure 18 – *Profile-Builder*, Creating a Profile

3.2.2 Creating a Logical Devices

In the Device Configurator, double-click the profile to which the logical device is to be added. As shown in Figure 19, a menu for that device can be brought up by right-clicking the mouse on the **'Device List'**. Add or delete a device by selecting from the pop-up menu.

- **Insert User Device**: Add the user device to the selected profile.
- **Remove All Devices**: Delete all devices of the selected profile.
- **Remove Device**: Delete the specific device of the selected profile.
- **Properties**: Check and modify the specific device.

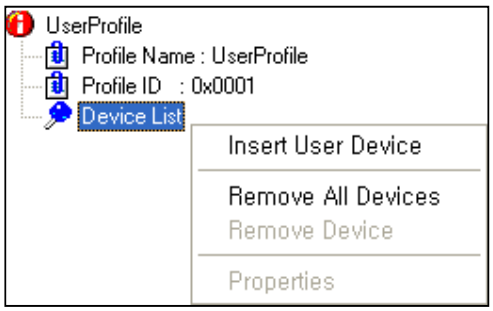

Figure 19 – *Profile-Builder*, Generating a Logical Device

By selecting **'Insert User Device'**, a new logical device can be defined. The screen in Figure 20 shows the fields needed to create the new device. In the logical device definition, the terms, **'In'** and **'Out'**, mean that the node can receive or transmit within the selected cluster. To define a new logical device, fill in the three fields and choose from the cluster list while also checking **'In'** and/or **'Out'** as appropriate, and click **'OK'**.

- **Profile Type**: The list of profiles currently available to ***Profile-Builder***.
- **Device Name**: A unique device name operating in the selected profile.
- **Device ID**: A unique ID for the device operating in the selected profile. (Acceptable values: 0x0001-0xFFFF.)
- **Cluster List**: The clusters for input and output in this device. Up to 8 input and output clusters may be specified.

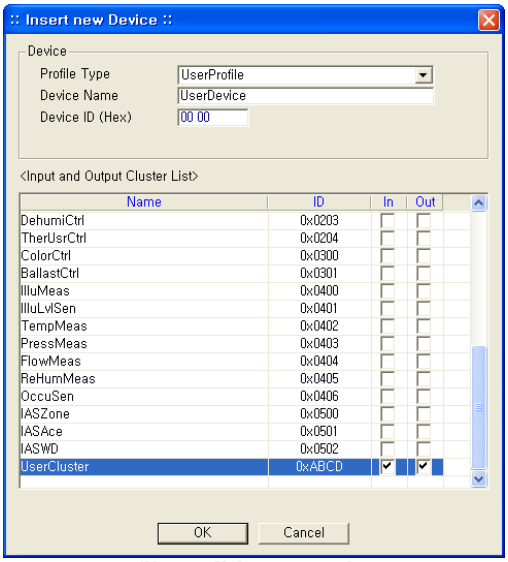

Figure 20 – *Profile-Builder*, Inserting a New Device

When the logical device has been generated, a new logical device will be shown as in Figure 21.

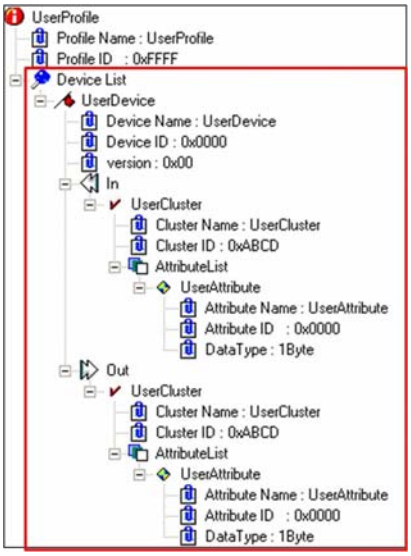

Figure 21 – *Profile-Builder*, Device List Outline

3.3 STEP 3: GENERATING A ZIGBEE PHYSICAL NODE

In the Application Workspace, one physical ZigBee node can be defined using the following information.

- Application system information
- Network information
- Power and current dispersion information
- Logical function unit (End-point) information

The information above is converted to the defined ZigBee Descriptor source code and stored in a file, named *profile.h*, to interface with the ***CEL ZigBee Stack***. The detailed instructions within *profile.h* are shown as an example in Figure 22.

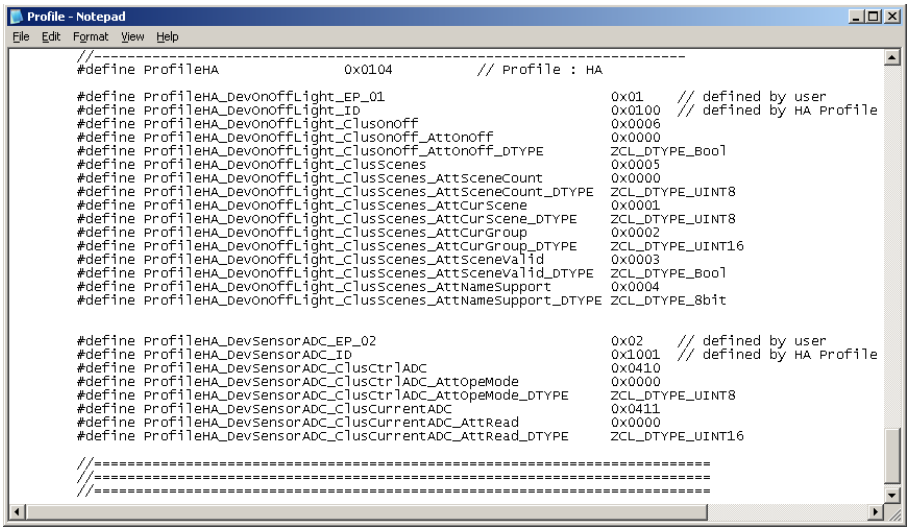

Figure 22 – User Profile and Device List as defined in *profile.h*

3.3.1 Initializing a ZigBee Node

A ZigBee node is initialized with the basic node information by right-clicking the mouse on **'UnKnownNode'** in the Application Workspace and selecting **'Initialize'**.

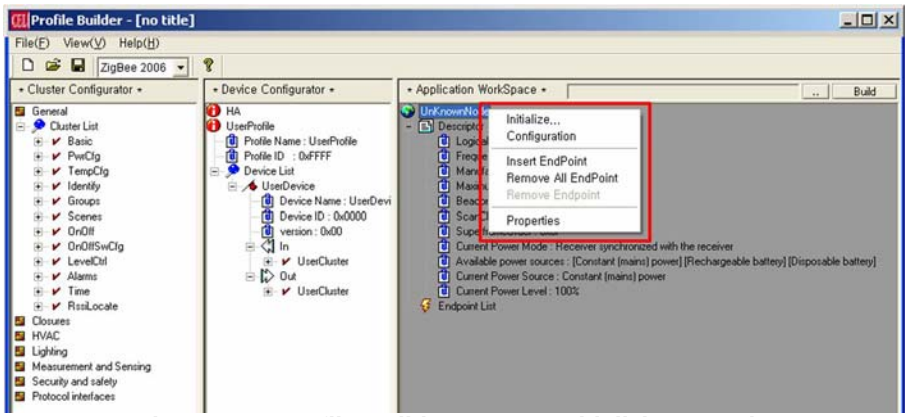

Figure 23 – *Profile-Builder* Pop-up, Initializing a Node

As shown in Figure 23, the following choices are available through this pop-up menu:

- **Initialize**: Initializes the Application WorkSpace (initializes the Configuration and deletes the Endpoint List).
- **Configuration**: Reviews or edits the currently stored ZigBee device information (the values of the node name and the settings of the entire descriptor).
- **Insert EndPoint**: Creates an End-point (Simple Descriptor) which includes Profile ID, Device ID and EndPoint ID.
- **Remove All EndPoints**: Initializes a Simple Descriptor by deleting all End-points.
- **Remove EndPoint**: Deletes selected End-point.
- **Properties**: Review or edit the setting values of a selected End-point.

By selecting **'Initialize'**, the window in Figure 24 is displayed to define the node's configuration. Input the **'Node Name'** in the appropriate space and click **'OK'**.

- **Node Name:** Any name assigned to the ZigBee node.

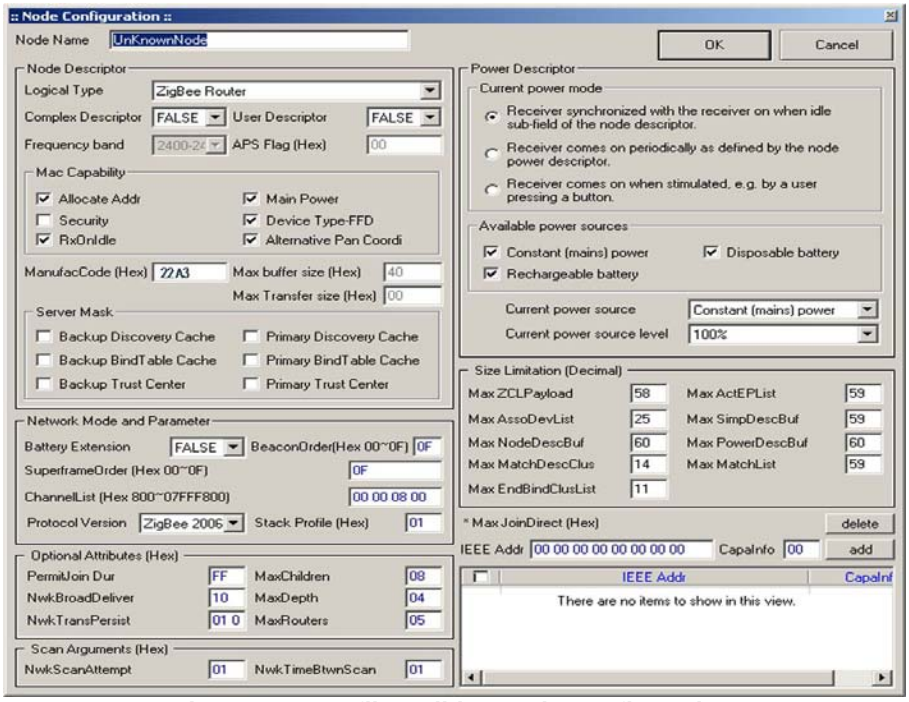

Figure 24 – *Profile-Builder*, Node Configuration

For more detailed node setting information, please refer to the ***"ZIC2410 User Guide ZigBee Device Object"*** document. Once the new node is set, it will be displayed as shown in Figure 25. Once a new node has been created, an End-point can be generated.

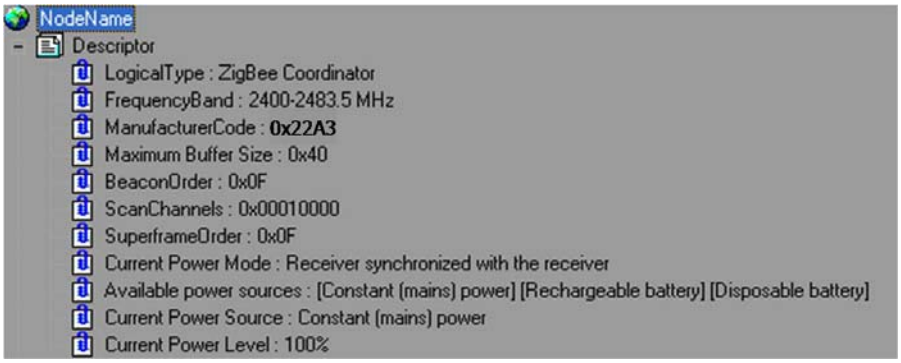
NodeName
Descriptor
LogicalType : ZigBee Coordinator
FrequencyBand : 2400-2483.5 MHz
ManufacturerCode : 0x22A3
Maximum Buffer Size : 0x40
BeaconOrder : 0x0F
ScanChannels : 0x00010000
SuperframeOrder : 0x0F
Current Power Mode : Receiver synchronized with the receiver
Available power sources : [Constant (mains) power] [Rechargeable battery] [Disposable battery]
Current Power Source : Constant (mains) power
Current Power Level : 100%

Figure 25 – *Profile-Builder*, Confirming Node Generation

3.3.2 Generating End-points

An End-point is a single logical function required by the physical device to either receive a response from another device or to control another device. For example, if one ZigBee Node is a light switch that has four physical light switches, then four End-points are needed. Or, if a sensor in one ZigBee Node has two sensor inputs, two End-points are needed.

To create a new End-point, right-click on **'UnKnownNode'** in the Application Workspace and select **'InsertEndPoint'** as shown in Figure 23 above. The Device List window in Figure 26 will be displayed. An End-point can be generated by inputting the desired values into the three fields and clicking **'OK'**.

- **Profile Type**: The name of profile which the End-point supports.
- **Device Type**: The type of the logical device of the End-point.
- **EndPoint**: A unique number assigned to each End-point (Acceptable values: 1-240).

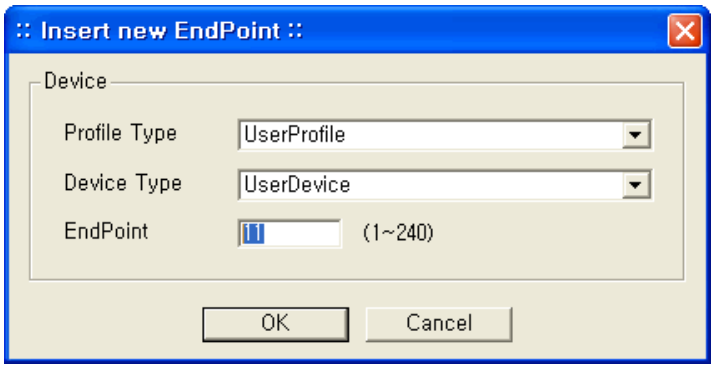

Figure 26 – *Profile-Builder*, New EndPoint

Note: It is recommended to assign the numbers of the End-points in order starting from 1.

After generating an End-point, the results will be as shown in Figure 27. To generate an additional End-point, simply repeat the procedure above.

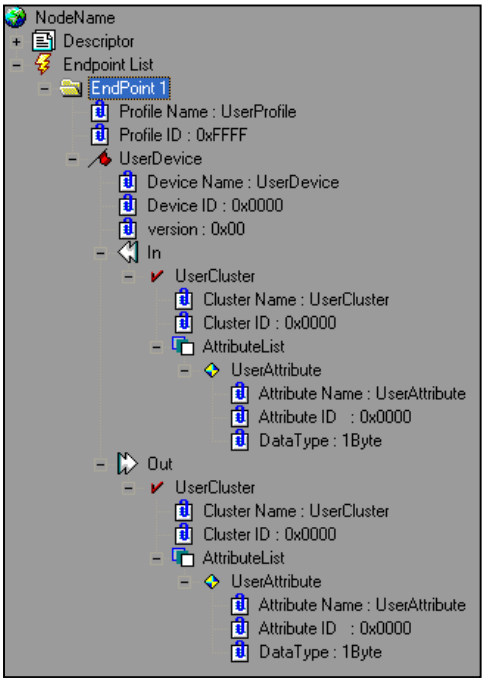

Figure 27 – *Profile-Builder*, End-point Results

3.4 STEP 4: BUILDING A SOURCE FILE

Once the profile and logical device including any End-points and Nodes have been created, use the **'Build'** button to create the five 'C' header source files: **'Profile.h'**, **ZZDO.h'**, **'ZZDO.c'**, **'ZZDO_CONF.h'** and **'ZZDO_TYPE.h'**. As shown in Figure 28 at the top of the Application Workspace, the directory into which these files are generated can be specified (The default directory is the **'My Documents'** folder).

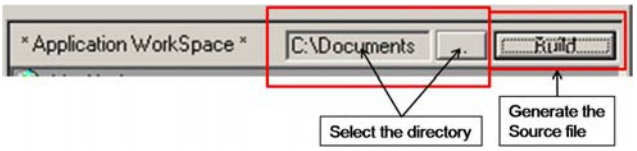

Figure 28 – *Profile-Builder*, Building Source Files

By clicking the **'Build'** button ***Profile-Builder*** creates the **'\C_Builder\'** directory in the defined path and generates the five files in that directory as shown in Figure 29.

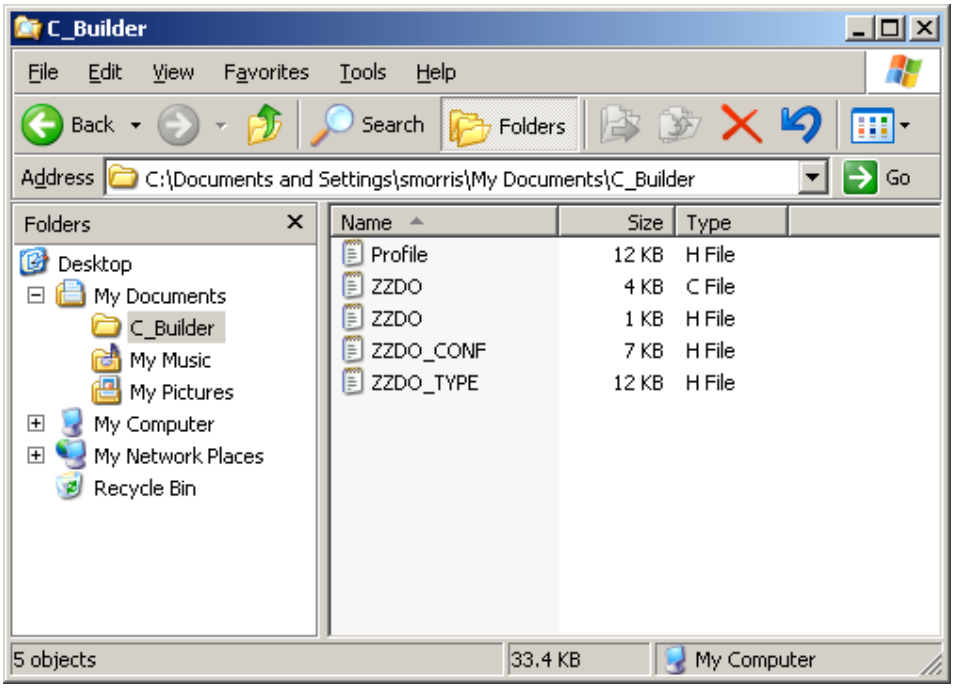

Figure 29 – Windows Explorer, Build Results

3.5 STEP 5: ADDING A FILE TO KEIL PROJECT

The source files generated by ***Profile-Builder*** should be integrated into a working project.

4 REVISION HISTORY

Revision	Date	Description
A	3Sep08	Released
B	13Jan09	Revised Table in Section 1.1; updated Hardware list in Section **Error! Reference source not found.**
C	11Jun09	General Cleanup. Removed Hardware References. Added detailed installation instructions and Vista compatibility.

A WINDOWS VISTA OPERATING SYSTEM

CAUTION: When the Operating System is Windows Vista (instead of Windows XP), the user must set the compatibility mode of the software tool.

1) After installing CEL ***Profile-Builder*** right-click the desktop icon and click on **'Properties'** in the pop-up menu.
2) Click on the **'Compatibility'** tab. (It may be necessary to delete what is written in the **'Start in'** field to access the **'Compatibility'** tab)
3) As shown below, check the box for **'Compatibility mode'** and select '**Windows XP'**.
4) Click **'OK'**.

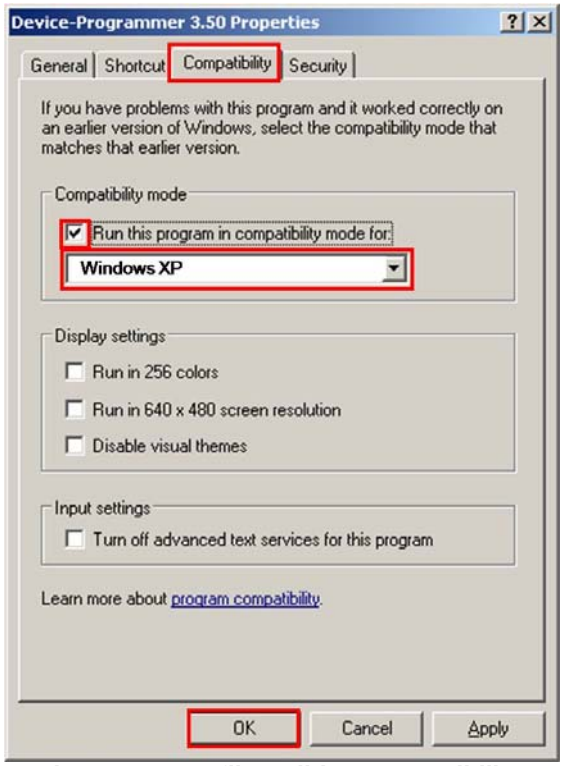
Device-Programmer 3.50 Properties
General
Shortcut
Compatibility
Security
If you have problems with this program and it worked correctly on an earlier version of Windows, select the compatibility mode that matches that earlier version.
Compatibility mode
Run this program in compatibility mode for:
Windows XP
Display settings
Run in 256 colors
Run in 640 x 480 screen resolution
Disable visual themes
Input settings
Turn off advanced text services for this program
Learn more about program compatibility.
OK
Cancel
Apply

Figure 30 – Profile-Builder, Compatibility